



# INSPIRE - ENGAGE - EDUCATE - EMPLOY

## The Next Generation of Explorers



## STEM ENGAGEMENT COMMITTEE

### REPORT TO NASA ADVISORY COUNCIL

# FEDERAL STEM EDUCATION 5-YEAR STRATEGIC PLAN

## Committee on STEM Education (CoSTEM)

- Co-chaired by NASA & NSF
  - Jim Bridenstine & France Cordova
- Coordinates STEM activities and programs
- Monitors overlap in federal STEM programs across agencies
- Develops strategic plan every five years

## Federal Coordination in STEM Education (FC-STEM)

- Co-chaired by NASA & NSF
  - Mike Kincaid & Karen Marrongelle
- Develops and coordinates five-year plan
- Communicates priorities across agencies
- Develops implementation structure

### FC-STEM MEMBERS:



### STEM EDUCATION ADVISORY PANEL:

Advises and evaluates CoSTEM's progress in meeting its goals. Established in 2018 by NASA, NSF, NOAA and the Dept. of Education with 18 panel members selected in 2018.

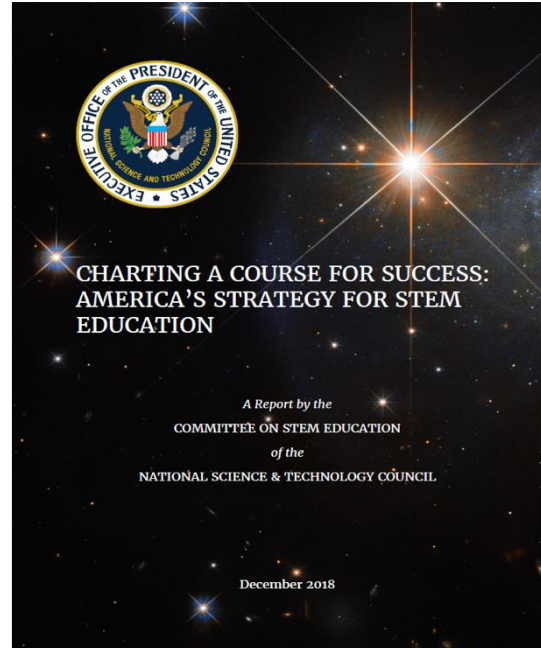
# STEM ENGAGEMENT 5-YR STRATEGIC PLAN

## VISION:

- A future where all Americans will have lifelong access to high-quality STEM education.
- The United States will be the global leader in STEM literacy, innovation and employment.

## ASPIRATIONAL GOALS:

- Build Strong Foundations for STEM Literacy
- Increase Diversity, Equity, and Inclusion in STEM
- Prepare the STEM Workforce for the Future



<http://www.whitehouse.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf>



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## GOALS FOR AMERICAN STEM EDUCATION

★ Build Strong Foundations for STEM Literacy ★

★ Increase Diversity, Equity, and Inclusion in STEM ★

★ Prepare the STEM Workforce for the Future ★

Pathways	Objectives	DOC	DOD	DOE	DOI	DOL	DOS	DOT	ED	EPA	HHS	NASA	NSF	SI	USDA
Develop and Enrich Strategic Partnerships	Foster STEM Ecosystems that Unite Communities	●	●	●	●		●	●	●	●	●	●	●	●	●
	Increase Work-Based Learning and Training through Educator-Employer Partnerships	●	●	●	●	●		●	●	●	●	●	●	●	●
	Blend Successful Practices from Across the Learning Landscape	●	●	●			●	●	●				●	●	●
Engage Students where Disciplines Converge	Advance Innovation and Entrepreneurship Education	●	●	●			●	●	●	●	●		●		●
	Make Mathematics a Magnet	●	●	●					●				●		●
	Encourage Transdisciplinary Learning	●	●	●	●			●	●	●	●	●	●	●	●
Build Computational Literacy	Promote Digital Literacy and Cyber Safety	●	●				●		●		●		●		●
	Make Computational Thinking An Integral Element of All Education	●	●	●	●				●		●		●	●	●
	Expand Digital Platforms for Teaching and Learning	●		●					●				●	●	●

## NASA'S CHOSEN OBJECTIVES

1. Foster STEM ecosystems that unite communities
2. Increase work-based learning and training through educator-employer partnerships
3. Encourage transdisciplinary learning

<https://go.nasa.gov/34kfh4s>

# RECOMMENDATION

## Short Title of Recommendation 1: STEM Integration Across Agency

The STEM Engagement Committee (Committee) greatly appreciates how the Office of STEM Engagement (OSTEM) is working to increase understanding among Mission Directorates and Centers via the STEM Engagement Council. The Committee also recognizes the challenges of this effort and the additional work necessary to identify potential improvements.

The Committee recommends additional efforts at cross fertilization and understanding among the NAC Committees on the STEM activities across the Agency. The Committee clearly sees a need for a more thorough understanding of the current goals, objectives, and status among the Mission Directorates and Centers concerning STEM activities and how these activities support the Agency meeting the goals and objectives of the Federal 5-Year STEM Strategic Plan.

**Rationale –** This is needed to assure NASA meets its commitments to the Federal 5-Year STEM Strategic Plan and efficient use of NASA / STEM resources for maximum impact toward the Federal 5-year STEM Strategic Plan

**Consequences of no action –** Lack of action can drive a lower probability of NASA achieving goals of the Federal 5-year STEM Strategic Plan. Lack of action also results in uncoordinated messaging and status among the various Mission Directorates and Centers on STEM activities and further confusion among STEM participants and implementation staff. Potential misalignment will adversely affect NASA's ability to meet the goals and objectives of the Federal 5 Year STEM plan.



# FINDINGS

## Short Title of Finding 1: Study on Sparking Interest in STEM

The STEM Engagement Committee (Committee) appreciates the work done to understand the generation and sustainment of “sparking” interest in STEM areas. The expert panel review and literature search provided valuable input to STEM Engagement Strategies. The “Spark” study conducted by Office of STEM Engagement (OSTEM) provides important knowledge and information for future STEM activities planning. The Committee looks forward to seeing the results of the action requesting OSTEM to develop a prioritization strategy for addressing the findings from the Spark study, at a future Committee meeting.

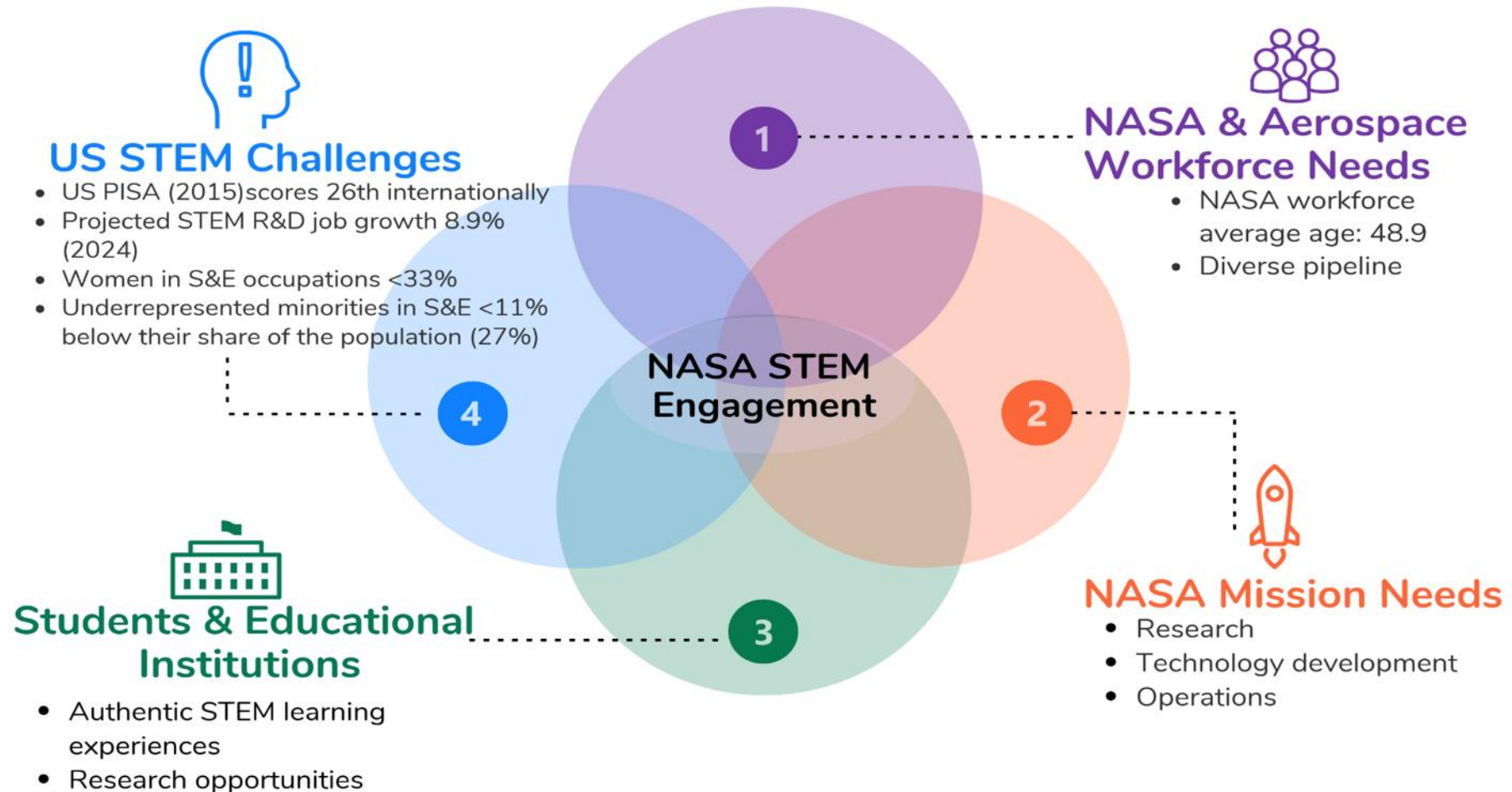
## Short Title of Finding 2: STEM Alignment and Diversity

The STEM Engagement Committee (Committee) applauds the effort to develop the direct correlation of the Office of STEM Engagement (OSTEM) objectives to the Federal 5-year STEM Strategic plan. This effort leads to an architecture enabling student opportunities in STEM activities based on results from the Spark study.

As OSTEM proceeds with the on-going planning effort the Committee would like the opportunity to review the resulting relationship of OSTEM activities to the overall Federal plan, and asks that OSTEM provide direct evidence demonstrating the direct support of the 5-year Federal STEM Strategic Plan. The Committee supports OSTEM’s plan to provide evidence of utilizing intentional activities and methods for assuring STEM activities reach the diverse, under served and under represented communities. The Committee also feels that metrics would be valuable to measure the results for reaching out to new communities.



# NASA'S CONTRIBUTIONS TO AMERICA'S STEM ECOSYSTEM



 NSF Science and Engineering Indicators Report (2015)



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# ARCHITECTURE ENABLING STUDENT OPPORTUNITIES & CONTRIBUTIONS

## NASA MISSION DIRECTORATE DRIVERS & REQUIREMENTS



Evidence-based strategies

Rigorous planning



Integrated operational model

## FOCUS AREAS

Create unique opportunities for students to contribute to NASA's work.

Build a diverse future STEM workforce by engaging students in authentic learning experiences.

Strengthen understanding of STEM by enabling powerful connections to NASA's mission and work.

Strategic, balanced portfolio

NASA-unique learning experiences



Student contributions to NASA's work in action

SCALABILITY TO MAGNIFY NASA'S REACH AND IMPACT

K-Elementary School



Middle School



High School



Undergraduate



Graduate



## BENEFICIARIES OF NASA'S STEM ENGAGEMENT PORTFOLIO

# NASA STRATEGY FOR STEM ENGAGEMENT

## FOCUS AREAS

Create unique opportunities for students to contribute to NASA's work

Build a diverse, skilled, future STEM workforce

Strengthen understanding of STEM by enabling powerful connections to NASA's mission

## OBJECTIVES

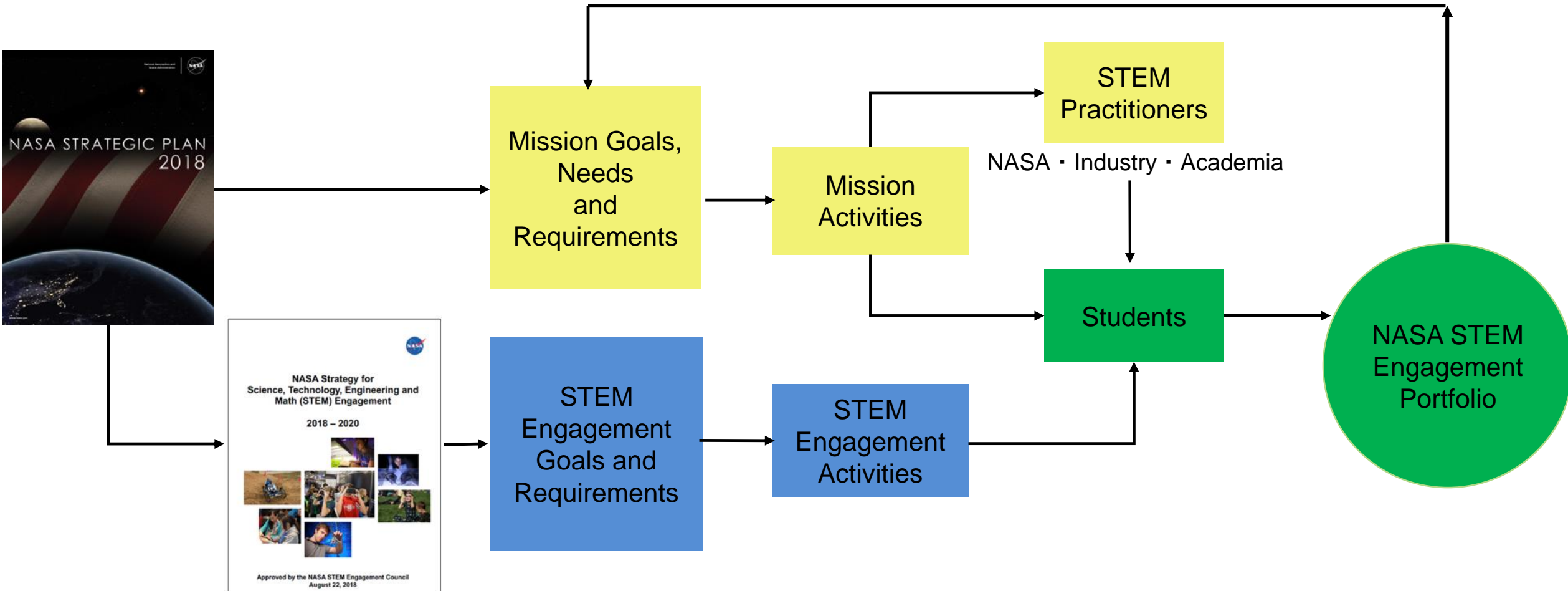
- 1.1 Students contribute to NASA's endeavors in exploration and discovery.
- 1.2 Research and development capacity of educational institutions is enhanced, enabling broad and diverse contributions that directly address NASA priorities.
- 2.1 Broad and diverse set of students are attracted to STEM through NASA opportunities.
- 2.2 Students, including underrepresented and underserved communities, explore and pursue STEM pathways through authentic learning experiences and research opportunities with NASA's people and work.
- 2.3 The portfolio of NASA STEM engagement opportunities meets Agency workforce requirements and serves the nation's aerospace and relevant STEM needs.
- 2.4 Strategic partnerships with industry, academia, non-profit organizations and educational institutions enhance and extend the impact of NASA's efforts in STEM engagement.
- 3.1 Youth are introduced to STEM concepts and content through readily available NASA STEM engagement resources and content.
- 3.2 Students gain exposure to STEM careers through direct and virtual experiences with NASA's people and work.



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# NASA STEM ENGAGEMENT PORTFOLIO - DRIVERS & CONTRIBUTIONS

*Student contributions to NASA's work in action*



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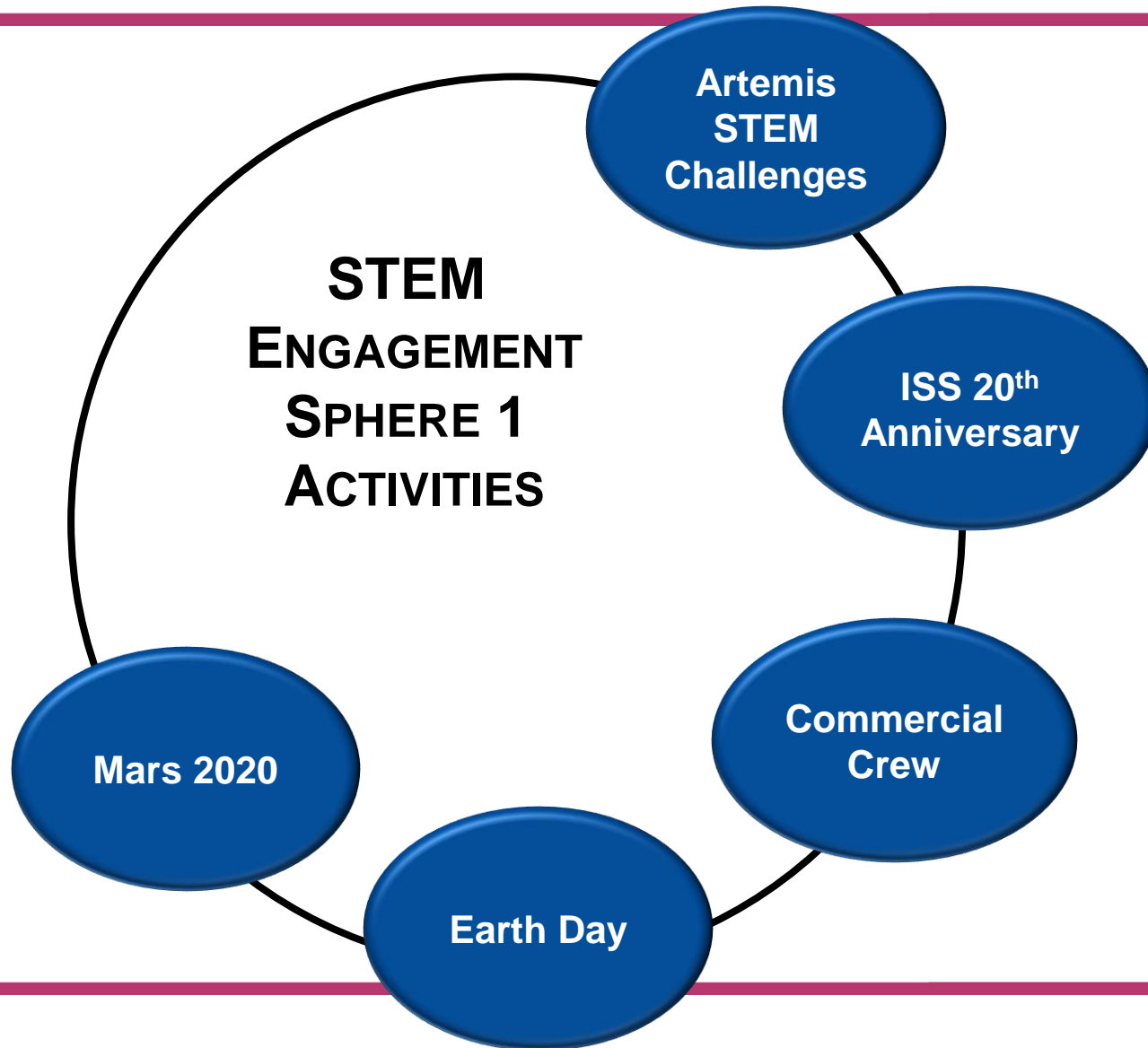
# NASA STEM ENGAGEMENT PORTFOLIO SNAPSHOT

## CONTRIBUTIONS BY ORGANIZATION

Types of Activities	ARMD	HEOMD	SMD	STMD	OSTEM	*Other	Totals
Internships		2	5		4		11
Challenges, Competitions & Contests	2	11	4	4	2	1	24
Fellowships	1			1	2		4
R&D Opportunities			2		9		11
Pre-College STEM Experiences		3	2		7		12
College STEM Experiences				1	4		5
STEM Content & Products	5			1	5		11
Virtual Learning Opportunity							
Institutional Support			2	1	4		7
Faculty & Educator Support			2	1	6		9
<b>Total:</b>	<b>8</b>	<b>16</b>	<b>17</b>	<b>9</b>	<b>43</b>	<b>1</b>	<b>94</b>

\*Note: Supported by Center-Based or other Functional Offices

# SPHERE 1 IMPACT AND SUCCESS CRITERIA



## Success criteria:

- Increased diversity of student and institution participation
- Movement along the continuum of the design principles
- Documented improvements and/or resulting outcomes
- Defined metrics for each activity
- STEM Engagement content is consistent and streamlined

## Envisioned impacts:

- Increased leverage and coordination of Agency resources
- Increased and broader participation
- Enhanced diversity of students and institutions
- Expanded geographic reach
- Expanded network across Agency and external partners
- Increased scope and scale
- Increased access to cadre of experts



# Artemis Student Challenges

- Integration with Mission Directorates to **enhance impact** of Student Challenges and **align** with **Artemis Program needs**
- FY20 solicitation will fund additional Space Grant opportunities

Human Exploration  
Rover Challenge

Student Launch

Micro-G  
NExT

2020 BIG Idea Challenge

First Nations Launch

Lunabotics  
Competition

Spacesuit User Interface Technologies for Students (S.U.I.T.S.)



[www.nasa.gov/joinartemis](http://www.nasa.gov/joinartemis)

# SPACE & STEM: How Do You Fit In?

## Who:

College Students, Young Professionals, Faculty

## Why:

To understand how the next generation of explorers play a role in the future of space exploration.

## MAJOR GOAL:

Through an interactive discussion with NASA early career professionals and senior leadership, students across the country will be able to hear about career paths, opportunities to engage with NASA and ask their questions

WATCH PARTIES **PARTNERS AIAA & SPACE GRANT**

62

Watch  
Parties

31

States +  
Puerto Rico  
& Korea

2,600

Estimated  
attendees



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# Commercial Crew



- Students and educators **embrace the importance** of achieving safe, reliable and cost-effective access to low-Earth orbit.
- Develop and deploy an evidence-based toolkit of resources and content for educators and students that includes **engineering challenges, coding, digital badging, virtual reality** and more.

## ISS @20

- Bring **ISS into the classroom!** Leverage STEM on Station content, provide student opportunities to engage in ISS research and deliver the excitement of science and technology to students in the classroom.
- *This is a milestone. It symbolizes exploration by all that dare to dream and work hard to achieve that dream – we hope an inspiration for all **future explorers**.* Astronaut Christina Koch, October 18, 2019.



# Mars 2020



- Create and disseminate **immersive virtual experiences**, classroom lessons and activities for students and educators in advance of the launch and landing of Mars 2020.
- Utilize Mars 2020 as a platform to **engage a broad and diverse** student population across the U.S.

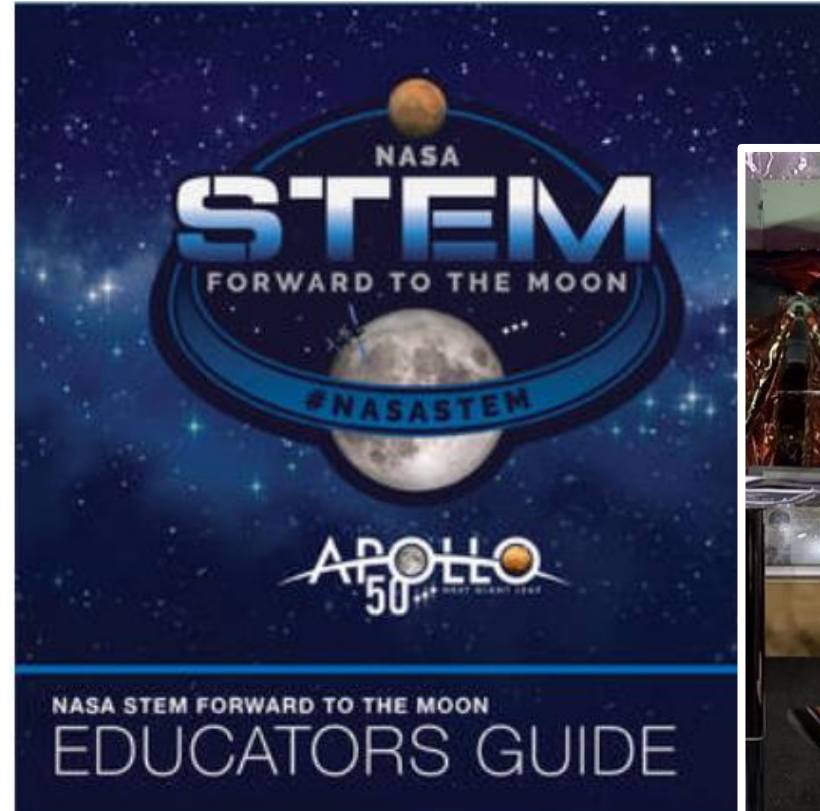
# Earth Day

- Engage students and educators through content, lessons and activities that use the vantage point of space to **understand and explore our home planet** and create powerful connections to the 50<sup>th</sup> Anniversary of Earth Day.



# HIGHLIGHT MOON TO MARS: STEM FORWARD TO THE MOON EDUCATORS GUIDE

- STEM Forward to the Moon Educators Guide includes hands-on science activities may be done at home with family, at summer camp or in a classroom.
- The guide and supporting activities supplemented the STEM Education segment of the Apollo Anniversary broadcast first aired on NASA TV July 19, 2019.



# STUDY TO UNDERSTAND THE STEM “SPARK”: EXPERT REVIEW PANEL & LITERATURE REVIEW

## Purpose

The Office of STEM Engagement should create a deep and comprehensive document describing what is known about sparking student interest, STEM engagement, and student motivation.

### Expert Review Panel and Literature Review

#### Themes

Four themes guided the ERP and Literature Review

**Sparking STEM  
Interest**

**NASA’s Role in  
Sparking STEM  
Interest**

**Engaging Diverse  
Students in STEM**

**NASA’s STEM  
Engagement  
Strategy**

### Literature Review

- Systematic procedure: search for relevant literature using EBSCO, google scholar, and National Academies Press databases.
- 100+ articles and National Academies sources.

### Expert Review Panel July 24, 2019

- 11 individuals with expertise aligned to areas of discussion
- Professors in Education, Learning, Research, Diversity, and STEM Education
- Representatives from agencies committed to education, research, science, and technology innovation

# STUDY TO UNDERSTAND THE STEM “SPARK”:

## PRIMARY FINDINGS

### Sparking STEM Interest

Sparking STEM interest was defined differently by panelists and literature.

A “spark” is:

- A moment that exposes an individual to a topic and serves as a precursor to engagement
- Involves **Phenomenon Learning**, or examination of phenomena.

According to Panelists

- A “spark” is not only how interest is triggered, but more importantly how it is maintained.

### NASA’s Role in Sustaining STEM Interest

Panelists disagreed regarding NASA’s role in sustaining STEM interest.

- NASA should take a direct, hands-on role.
- NASA should serve as facilitator to collaborators (e.g., ecosystems, agencies, public entities, and stakeholders) who provide hands-on sustainment efforts.

### Engaging Diverse Students in STEM

Methods for supporting and measuring “spark”, sustainment, and motivation to persist may differ among diverse groups.

- There is no silver bullet.
- More research is needed to better understand differences.
- Strategies and measurement methods may differ by group.